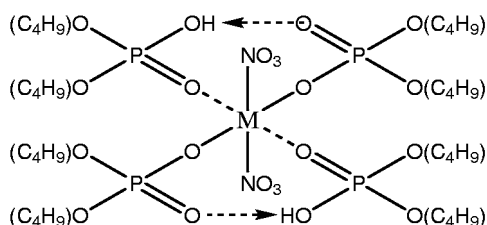


Liquid-Liquid Extraction of ^{257}Rf with the SISAK system as a $\text{Rf}(\text{Nitrate})\cdot(\text{Dibutyl-Phosphate})$ Complex

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The SISAK liquid-liquid extraction system [1] was used to extract 4.3 s ^{257}Rf . The ^{257}Rf was produced in the reaction $^{208}\text{Pb}(^{50}\text{Ti}, \text{n})^{257}\text{Rf}$ and separated in the Berkeley Gas-filled Separator (BGS). The activity exiting the BGS was transferred to a gas jet by a recently constructed recoil transfer chamber (RTC) [2] and transported to the SISAK system in a 20 m Ø1.56 mm capillary.

The activity was then dissolved in 6 M HNO_3 and Rf extracted into an organic phase (0.25 M dibutyl-phosphoric acid (HDBP) in toluene). Under these conditions the Rf homologues Zr and Hf are extracted as a nitrate-dibutyl-phosphate complex:



where M is the metal ion [3]. It was expected that Rf would extract in the same way, and one of the main aims of the experiment was to prove this. After the extraction the organic phase is washed with 2 M NaNO_3 to remove HNO_3 , mixed with the scintillator ingredients, and flushed with He to remove O_2 . Fig. 1 shows a schematic drawing of the experimental setup and chemical procedure.

During 7.1 hours of beam time four $^{257}\text{Rf} \Rightarrow ^{253}\text{No}$ α - α correlations were observed in the first of the three detectors (preliminary result).

On the basis of the number of Rf-No correlations reaching the SISAK detectors without any chemistry [4] and the number of correlations observed in the organic phase after extraction, a distribution ratio, D , can be

calculated: If R_{Org} is the activity detected in the organic phase and R_{Tot} the total activity entering the system, then the activity in the aqueous phase, R_{Aq} , and therefore the distribution ratio can be calculated:

$$D = \frac{[\text{Rf}]_{\text{Org.}}}{[\text{Rf}]_{\text{Aq.}}} = \frac{R_{\text{Org.}}}{R_{\text{Aq.}}} = \frac{R_{\text{Org.}}}{R_{\text{Tot}} - R_{\text{Org.}}}$$

The numbers must be normalised with respect to differences in beam dose, transport time losses, and liquid flow rate, etc. These corrections factors have not yet been precisely determined. However, it can be confirmed that Rf extracts with a high yield (>60%), similarly to Zr and Hf.

This is the first time a transactinide, i.e. an element with $Z \geq 104$, has been extracted and equivocally identified by the SISAK system. Thus, it demonstrates that the on-line SISAK liquid-liquid extraction system and its liquid-scintillation detectors can be used for investigating the chemical properties of the transactinides.

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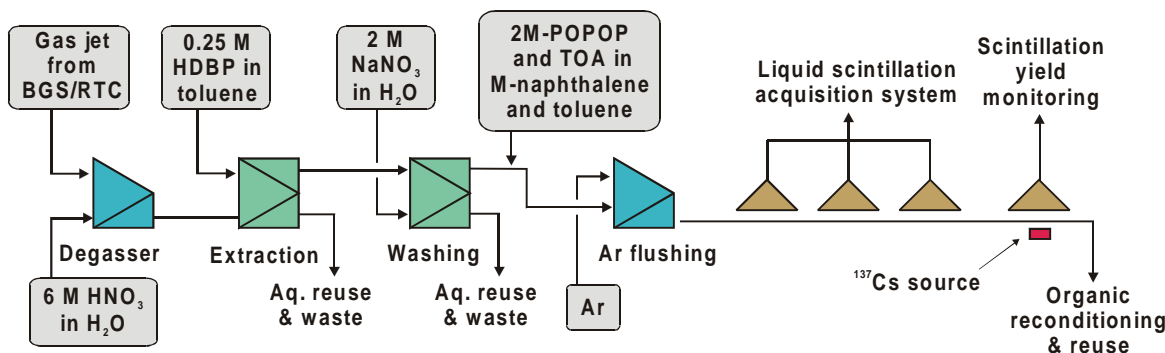


Figure 1 The SISAK setup for extracting Rf with HDBP from nitric acid.